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# **SENSORY AND QUALITY ANALYSIS OF GLUTEN FREE MILLET POLES INFLUENCING THE TECHNOLOGY OF VACCUM PACKAGING**

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## **ABSTRACT**

*Millets are one of the most important draught resistant crops and the sixth cereal crop in terms of world agricultural production. Climatic changes, water scarcity, increasing world population, rising food prices and other socio-economic impacts are expected to generate a huge threat to agriculture and food security worldwide. These impacts tends to investigate the possibilities of most important source of world's food and have a significant role in the human diet throughout the world. Millet poles are said to be a nutritional product which is composed of gluten free millets with acceptable appearance and texture by the technology of vaccum packaging. This technique is on one of the expeditiously growing packaging technology used in preserving various food products regardless of the material's quality and quantity with an appreciable shelf life extension carried over by freezing to enhance the physical and textural properties.*

**KEYWORDS:** *Millets, vaccum packaging, freezing, shelf life extension.*

## **INTRODUCTION**

Millets are a group of highly variable small seeded grasses widely grown around the world as cereal crops or grains for fodder and human food. They are indigenously taken by people all around the world and they potentially have a pivotal role in the rise of multi crop agricultural and settled farming societies. The product millet fingers is prepared by combination of kodo millet and little millet which are basically minor millets and they are small grained, annual, warm weather cereals highly tolerant of drought and extreme

weather conditions .To ensure that the product is good texture and has good binding capacity. Jowar is added as a substitute for attaining a good product quality.

Millet fingers are prepared by the combination of these three millets (kodo, little and jowar) which are not added as such but in the form of porridges to attain a proper composition and quality. Basically porridge is a traditional food in Russian cuisine which is eaten sweet or savoury with meat or vegetable stews. People affected by gluten related disorders, such as coeliac disease, non-celiac gluten sensitivity and wheat allergy

sufferers who are in need of gluten free diet and replace gluten containing cereals in their diets with millets.

In order to extend the shelf life of the product once the porridge reached the appropriate consistency they are refrigerated for a maximum of 8 hours and they are packed by using the method of vacuum technology.

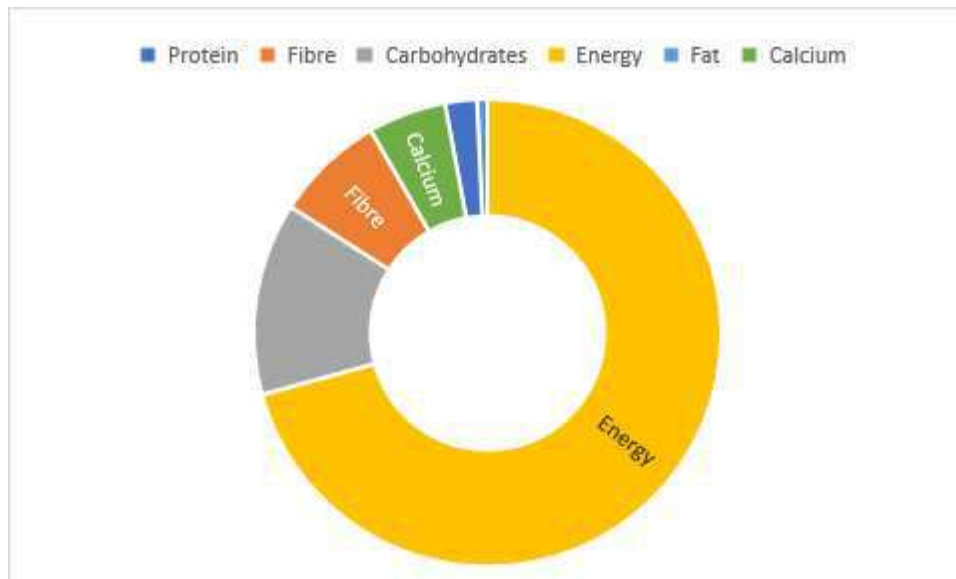
In serving 100 grams raw millets we are provided with 378 calories, 20% or more of the daily value of protein, dietary fiber, several B vitamins and numerous dietary minerals especially manganese at 76% daily value, 9% water, 73% carbohydrates, 4% fat and 11% protein.

However when millets compared to major staple foods they are not edible and fully digested and

hence these must be prepared and cooked as appropriate for human consumption.

**KODOMILLET: (*Paspalum scrobiculatum*)**

Kodo millet is an annual grain that is primarily grown in India, it is grown as a minor crop. It is said to be very hardy crop that is drought tolerant and can survive on marginal soils, and can supply 450-900 kg of grain per hectare, they vary in color from being light brown to dark grey. Kodo millet is ground into flour and used to make pudding and porridges. Paspalum ergot is a fungal disease to which causes damage to the central nervous system, cleaning the seeds by winnowing them before storage may remove the fungal spores.



**FIG (I) Nutritive Value of Kodo Millet (100g)**

**LITTLE MILLET: (*Panicum sumatrense*)**

This species is very smaller in size which grows straight or with folded blades to the height of 30 cm to 1 cm. The grain is round and smooth, 1.8 to 1.9 mm long. It can withstand both draught and waterlogging conditions. Little millet is cooked very similar to rice, the millet is also milled and baked. The little millet has the ability to protect heart health, diabetes, improve digestive system, lowers the risk of cancer, detoxify the body, boost respiratory health, increase energy levels, improves muscle and nerve health.

100g of raw millet has the nutritive value

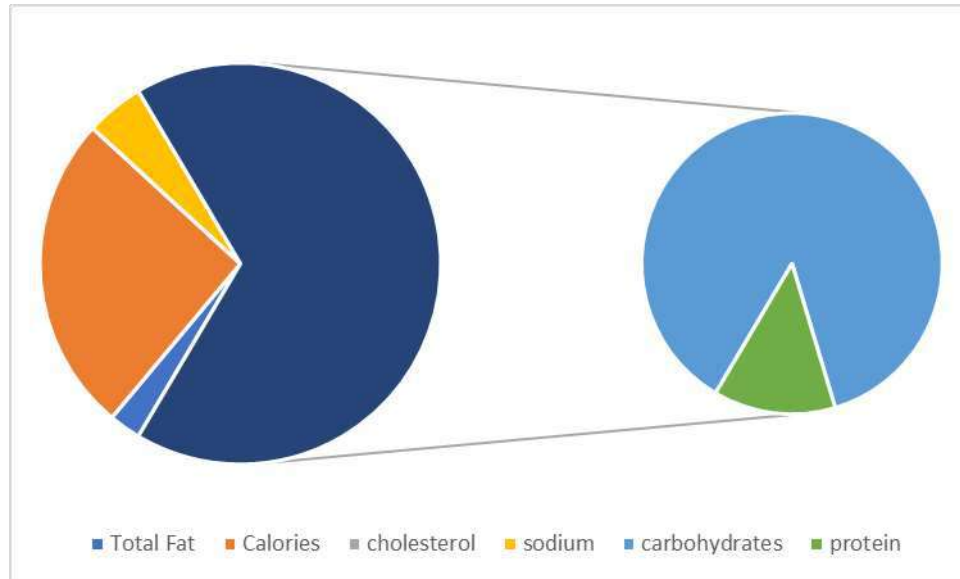
- Energy-341 Kcal
- Carbohydrates-67 g
- Dietary fibre-7.6 g
- Fat-4.7 g
- Protein-7.7 g
- Minerals -8g.

**JOWAR: (*Sorghum bicolor*)**

Jowar is most commonly used as food for humans, animal feed and ethanol production and it is said to be world's fifth most important cereal crop,

usually grown in clumps that may reach over 4m high. The grain is small, ranging from 2 to 4 mm in diameter, they are used in a numerous ways such as the preparation of white wine, baking, growing a number

of ethanol plants, tortillas, beer using red sorghum. Sorghum is one of a grain used as wheat substitutes in gluten free products. Sorghum has a greatest acceptability as a raw material in the industry.



**FIG (II) Nutritive Value of sorghum(100g)**

**HEALTH BENEFITS  
BENEFICIAL FOR POSTMENOPAUSAL  
WOMEN**

Kodo millet is said to contain high amount of lecithin and is a good source for strengthening the nervous system, Regular consumption is very beneficial for postmenopausal women suffering from signs of cardiovascular disease.

**DIGESTION FRIENDLY**

They are composed of fiber content and so it helps hydrate colon to keep or system regular and prevent us from being constipated, regulates blood sugar levels and curbs the risk of strokes.

**RICH SOURCE OF PROTEIN**

Millet in general especially jowar has a whopping amount of proteins. Proteins helps build muscles, regeneration of cells, induce a feeling of satiety which helps further in weight reduction diet.

**GLUTEN-FREE**

Gluten refers to a mixture of proteins specially found in wheat, rye, oats and barley which in turn causes digestive problems such as bloating pain and stomach cramps for those who are allergic to protein. Jowar is a gluten free whole grain is considered an excellent

alternative for the one who suffer from “gluten intolerance”.

**PREVENTS ASTHMA**

Millet can significantly improve the quality of life for people suffering from asthma, it is shown that significantly less wheezing and asthma attacks were seen in children who had a large intake of grains.

**VACCUUM PACKING**

Vacuum packing is a method of packaging that removes air from the package prior to sealing. This method is aid to be simple and plastic bag is typically used for packaging. Once the product is placed in a machine, the lid is closed and the air is evacuated, the heat seal present inside the chamber will seal the bag, once the bag is sealed the chamber is again refilled with air by the automatic opening of a vent. The upcoming pressure squeezes all remaining air in the bag and finally the product is removed, chamber sealers are typically used for low-to medium volume packaging.

It is also termed as reduced oxygen packaging or ROP. Vacuum packaging of food materials helps in preserving the quality of packed products. The evaporation of volatile compounds from the food is

prevented thereby avoiding the taste, aroma, flavor and nutrition of the food lost.

The main objective of vacuum packaging is to deplete the oxygen content in the package. Due to the lack of oxygen, the aerobic microorganisms gets reduced in number which is the cause of spoilage in majority of the food products. The occurrence of spoilage due to the oxidation is also reduced. Another advantage in case of storage and transport is the volume of the package is reduced with flexible packaging materials. The maximum shelf-life of a vacuum sealed food product is upto one year. There are different types of vacuum sealing machines including external vacuum sealers, vacuum chamber machines, double vacuum chamber machines, automatic belt vacuum chamber machines etc.

#### **ADVANTAGES OF VACUUM PACKAGING**

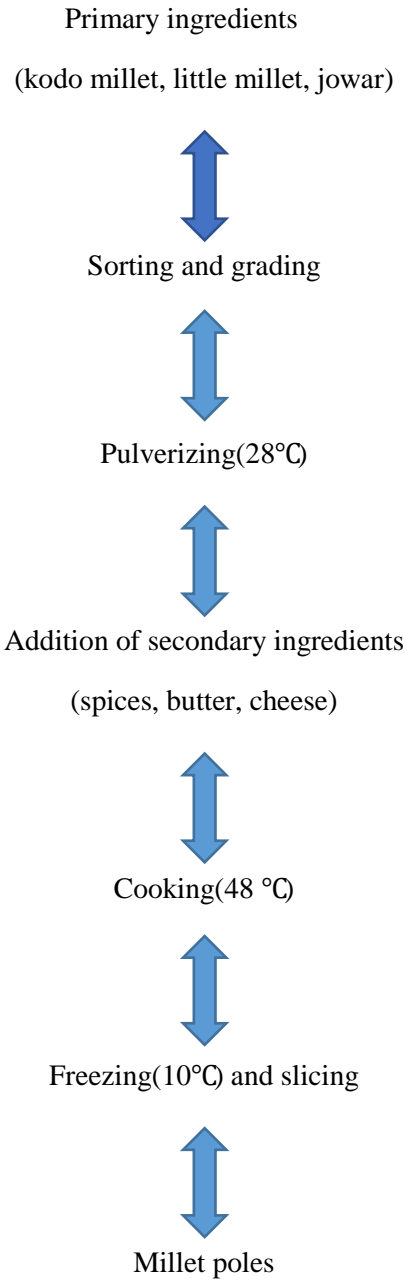
When compared to other forms of conventional storage methods, vacuum packed food materials lasts for 3-5 times longer.

Freezer burn, which is one of the main cause during the freezing of a food product can be eliminated as the packed food materials are not allowed to dehydrate that is avoiding its exposure to cold, dry air. It is an extremely economical process of packaging.

The shelf-life extension of a vacuum packed food product depends on the product, atmosphere, temperature and especially the barrier properties of the package. The barrier structure should be composed of two important layers such as PA for puncture resistance and PE for sealing. Examples of barrier bags include poly vinylidene chloride(PVDC) and ethylene vinyl chloride(EVOH).

Vacuum packaging can be used in combination with other food processing techniques such as retorting or refrigeration, which helps in inhibiting the growth of anaerobic microorganisms especially spore forming non-proteolytic *Clostridium botulinum*, *Yersenia enterocolitica* etc.

**PROCESS FLOW CHART**



FIG(III)

\*Primary Ingredients: Kodo Millet, Little Millet, Jowar  
\*Secondary Ingredients: Spices, Butter, Cheese  
To determine and to withstand the texture and quality of products various trials have been done with varying quantity of the primary and the secondary ingredients.

**TRIAL:1**

Kodo millet, little millet, jowar are taken in the ratio of 2:1:2 which are dry roasted and pulverized at room temperature(28-32°C).Once they are brought to uniform size .they are further added with secondary ingredients(butter, spices) to enhance the taste of the

product. The mixture is now baked for 15 minutes at a temperature of 34°C, later they are frozen(10°C) and sliced which is said to be eaten as a snack or breakfast.

**TRIAL: 2**

The primary ingredients taken in the ratio of 2:2:2 which are reduced in size by pulverizing at a temperature of 34°C and they are topped with the taste and enhancing agents which includes butter and spices. The mixture is now steamed for ideally 20 minutes at a predetermined temperature 32°C and they are frozen at a temperature of 11°C and sliced and so can be fried or pan cooked and can be consumed as a breakfast or snack.

**TRIAL: 3**

The gluten free millets kodo, little millet and jowar and approximated to a ratio of 2:2:1 which are pulverized to fine molecular structure at a temperature of 30°C and to give the essential taste to the product certain spices and butter are added to enhance taste of the product. The premixed mixture is now baked uniformly at an ideal temperature of about 34°C for 15 minutes. Once the baked product is cooled they are sliced to a definite size and then frozen at a temperature of 10°C. The frozen product is packed and can be either consumed by frying or pan frying as breakfast or snack. The product is said to have shelf-life for an extended period of two months when stored under proper refrigerated conditions.

**QUALITY ANALYSIS**

Food analysis is a discipline dealing with the development, application and study of analytical procedures for characterizing the properties of foods and their substantial constituents and ensures that the product is desirable and acceptable to the consumers which may be either physical or chemical said to be sensory. Quality analysis of the product is a very essential aspect which helps in improving the product quality with all the essentialities required to satisfy the needs of the general public. Determining the quality of millet poles includes moisture content, ash content which determines the minerals present, fats and oils tests and sensory evaluation.

**MOISTURE CONTENT: (OVEN METHOD)**

The determination of moisture content by drying oven method is said to be a thermo-gravimetric method where the sample is dried for a defined period of time (3 hours) at a constant temperature (105°C). The initial weight of the sample is noted and finally the weight of the sample is observed after drying. The difference in the weight is determined as the amount of moisture content present.

The moisture content of a food material is defined through the following equation:

$$\% \text{Moisture} = \left( \frac{m_w}{s_{\text{sample}}} \right) \cdot 100$$

Where  $m_w$  is the mass of the water and  $s_{\text{sample}}$  is the mass of the sample. The mass of water is related to the number of water molecules ( $n_w$ ) by the following expression:  $m_w = n_w M_w / N_A$ , where  $M_w$  is the molecular weight of water (18.0 g per mole) and  $N_A$  is Avogadro's number ( $6.02 \cdot 10^{23}$  molecules per mole). The moisture content is determined by measuring the mass of a food before and after the water is removed by evaporation

- $M_{c_{wb}} = m_{c_{db}} / 1 + m_{c_{wb}}$
- $M_{c_{db}} = m_{c_{wb}} / 1 + m_{c_{wb}}$

**2. Ash content**

Ash content is determined for almost all the products which are in the powdered form which evaluates the mineral content present in the product. The sample is placed in the muffle furnace for 3 hours at 553 degree celcius and the ash content is found to be 3% which is highly appreciable. Determining the ash content may be important for several reasons. It is part of proximate analysis for nutritional evaluation. Ashing is the first step in preparing a food sample for determination of minerals.

- $\% \text{ Ash (dry basis)} = M_{\text{ASH}} / M_{\text{DRY}} \cdot 100$
- $\% \text{ Ash (wet basis)} = M_{\text{ASH}} / M_{\text{WET}} \cdot 100$

**Table: 1**

S.NO	WEIGHT OF SAMPLE	WEIGHT OF CRUCIBLE	WEIGHT OF SAMPLE WITH CRUCIBLE		ASH CONTENT
			INITIAL	FINAL	
1.	5 g	0.026	0.031	0.026	0.5%

**CALCULATIONS FOR ASH TEST :**

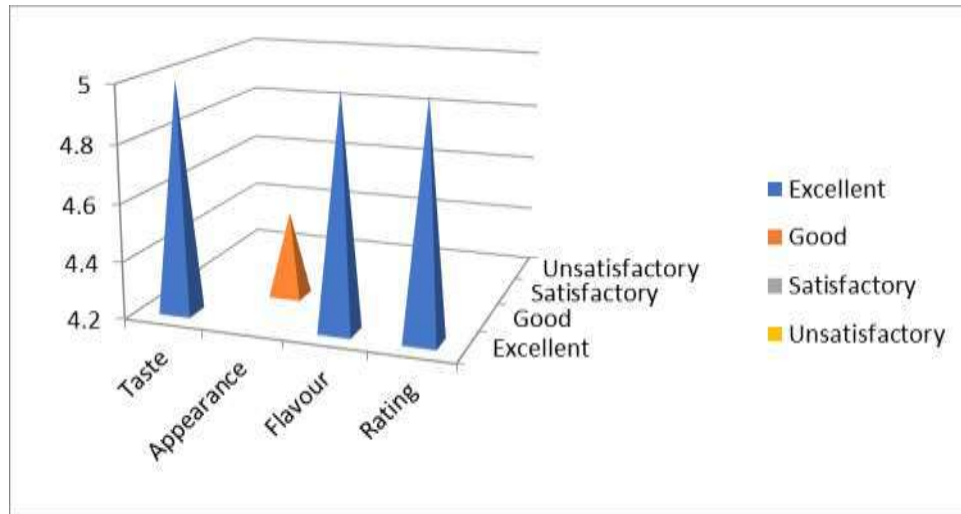
Weight of sample before heating = 0.031 g  
 Weight of sample after heating = 0.026g  
 Weight of total ash (W1-W2) = 0.031 - 0.026  
 ASH CONTENT =  $0.005 \times 100$   
 = 0.5%

**3. Organoleptic Taste:**

The sample that is made to prepare the payasam is organoleptically tested and various parameters such as the taste, flavor, texture, consistency are evaluated and changes are made according to the requirement and sugar is added according to the desired taste.

**Table:2 Sensory evaluation**

People opinion (excellent, good satisfactory, unsatisfactory)	Taste (out of 5)	Appearance (out of 5)	Flavour (out of 5)	Rating (out of 5)
Excellent	5	-	5	5
Good	-	4.5	-	-
Satisfactory	-	-	-	-
Unsatisfactory	-	-	-	-



**FIG(IV)Sensory Evaluation Of The Quality Of The Product (out of 5)**

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